CLAIMS

What is claimed is:

1. A process of forming at least one framed membrane electrode sub-assembly comprising:

a.) forming at least one framed membrane electrode assembly component comprising an external frame having a plurality of bridges, and at least one element having a plurality of outer edges, wherein the at least one element is connected to the external frame via the plurality of bridges, thereby forming a unitary structure;

b.) forming a carrier material having a plurality of apertures defined by a plurality of inner edges; and

c.) securing the carrier material to the at least one framed membrane electrode assembly component, wherein the external frame, and plurality of outer edges of the at least one element are supported by the carrier material, thereby forming at least one framed membrane electrode sub-assembly.

2. The process of Claim 1 wherein the at least one framed membrane electrode assembly component is selected from the group consisting of a proton exchange membrane, a gas diffusion layer, a gas diffusion electrode and a catalyst coated membrane.

3. The process of Claim 2 wherein the gas diffusion electrode comprises a gas diffusion layer and an electrode.

4. The process of Claim 2 wherein the catalyst coated membrane comprises a proton exchange membrane and an electrode.

5. The process of Claim 3 or 4, wherein the electrode is an anode or cathode.

6. The process of Claim 1, wherein the framed membrane electrode assembly component has a thickness of about 150 microns to about 1000 microns.

7. The process of Claim 1, wherein the at least one element is rectangular.

8. The process of Claim 1, wherein the carrier material comprises a thermoplastic material, a thermoplastic composite material or mixtures thereof.

9. The process according to Claim 8, wherein the thermoplastic material is selected from the group consisting of melt-processible

fluoropolymers, polyvinylidene fluoride, thermoplastic fluoroelastomers, aromatic condensation polymers, modified polyethylene, modified polypropylene, polyethylene, thermoplastic elastomers, liquid-crystal polymers, and aromatic polyamides.

10. The process according to Claim 8, wherein the thermoplastic composite material comprises at least one thermoplastic material containing a filler or reinforcing layer, wherein the thermoplastic material is selected from a melt-processible fluoropolymers, polyvinylidene fluoride, thermoplastic fluoroelastomers, aromatic condensation polymers, modified polyethylene, modified polypropylene, polyethylene, thermoplastic elastomers, liquid-crystal polymers, and aromatic polyamides, and wherein the filler or reinforcing material is selected from the group of fiber glass and glass cloth..

11. The process according to Claim 1, wherein the carrier material has a thickness ranging from about 10 microns to about 125 microns.

12. The process of Claim 1 further comprising: repeating steps (a) to (c) to form additional framed membrane electrode sub-assemblies.

13. The process of Claim 12 wherein the framed membrane electrode sub-assembly formed by repeating steps (a) to (c), is a complementary framed membrane electrode sub-assembly to the first formed framed membrane electrode sub-assembly.

14. The process of Claim 1 further comprising:

d.) separating the at least one element from the external frame, wherein the bridges and attached material are removed; and

e.) contacting the framed membrane electrode sub-assembly with additional components to form a framed membrane electrode assembly array.

15. The process of Claim 14 wherein the at least one framed membrane electrode assembly component comprises a gas diffusion layer, and the framed membrane electrode sub-assembly formed in step (c) is placed on either side of a catalyst coated membrane followed by pressing to form a framed membrane electrode assembly array.

16. The process of Claim 14 wherein the at least one framed membrane electrode assembly component comprises a gas diffusion electrode, and the framed membrane electrode assembly array is prepared by pressing together a sandwich formed by the framed

membrane electrode sub-assemblies formed in step (c) and an ion-exchange membrane disposed there between.

17. The process of Claim 14 wherein the at least one framed membrane electrode assembly component comprises a catalyst coated membrane, step (e) precedes step (d), and framed membrane electrode assembly components each comprising a gas diffusion layer are placed on either side of the framed membrane electrode sub-assembly formed in step (c), followed by pressing to form the framed membrane electrode assembly array.

18. The process of Claim 14 wherein the at least one framed membrane electrode assembly component comprises a proton exchange membrane, step (e) precedes step (d), and framed membrane electrode assembly components each comprising a gas diffusion electrode are placed on either side of the framed membrane electrode sub-assembly assembly formed in step (c), followed by pressing to form the framed membrane electrode assembly array.

19. The process of Claim 14 wherein the framed membrane electrode assembly component has a thickness of about 150 microns to about 1000 microns.

20. The process of Claim 14 wherein the at least one element is rectangular.

21. The process of Claim 14 wherein the carrier material comprises a thermoplastic material, a thermoplastic composite material, or mixtures thereof.

22. The process of Claim 21 wherein the thermoplastic material is selected from the group consisting of melt-processible fluoropolymers, polyvinylidene fluoride, thermoplastic fluoroelastomers, aromatic condensation polymers, modified polyethylene, modified polypropylene, polyethylene, thermoplastic elastomers, liquid-crystal polymers, and aromatic polyamides.

23. The process according to Claim 21, wherein the thermoplastic composite material comprises at least one thermoplastic material containing a filler or reinforcing layer, wherein the thermoplastic material is selected from a melt-processible fluoropolymers, polyvinylidene fluoride, thermoplastic fluoroelastomers, aromatic condensation polymers, modified polyethylene, modified polypropylene, polyethylene, thermoplastic elastomers, liquid-crystal polymers, and aromatic polyamides, and wherein

the filler or reinforcing material is selected from the group of fiber glass and glass cloth..

24. The process of Claim 14 wherein the carrier material has a thickness ranging from about 10 microns to about 125 microns.

25. The process of Claim 1 wherein a plurality of framed membrane electrode sub-assemblies are formed.

26. The process of Claim 14 wherein a plurality of framed membrane electrode arrays are formed.

27. A framed membrane electrode sub-assembly prepared by a process comprising:

a.) forming at least one framed membrane electrode assembly component comprising an external frame having a plurality of bridges, and at least one element having a plurality of outer edges, wherein the at least one element is connected to the external frame via the plurality of bridges, thereby forming a unitary structure;

b.) forming a carrier material having a plurality of apertures defined by a plurality of inner edges;

c.) securing the carrier material to the at least one framed membrane electrode assembly component, wherein the external frame, and plurality of outer edges of the at least one element are supported by the carrier material, thereby forming at least one framed membrane electrode sub-assembly.

28. The framed membrane electrode sub-assembly of Claim 27 wherein the framed membrane electrode assembly component is selected from the group consisting of a proton exchange membrane, a gas diffusion layer, a gas diffusion electrode, and a catalyst coated membrane.

29. A framed membrane electrode assembly array comprising a framed membrane electrode sub-assembly prepared by a process comprising:

a.) forming at least one framed membrane electrode assembly component comprising an external frame having a plurality of bridges, and at least one element having a plurality of outer edges, wherein the at least one element is connected to the external frame via the plurality of bridges, thereby forming a unitary structure;

b.) forming a carrier material having a plurality of apertures defined by a plurality of inner edges;

c.) securing the carrier material to the at least one framed membrane electrode assembly component, wherein the external frame, and plurality of outer edges of the at least one element are supported by the carrier material, thereby forming at least one framed membrane electrode sub-assembly.

30. A fuel cell comprising a membrane electrode assembly produced according to the process of Claim 14.

31. The fuel cell of Claim 30 wherein the frame is removed.

32. The fuel cell of Claim 30 wherein the process for producing the membrane electrode assembly further comprises:

d.) separating the at least one element from the external frame, wherein the bridges and attached material are removed; and

e.) contacting the framed membrane electrode sub-assembly with additional components to form a framed membrane electrode assembly array.

33. The fuel cell of Claim 32, wherein the at least one framed membrane electrode assembly component comprises a gas diffusion layer, and the framed membrane electrode sub-assembly formed in step (c) is placed on either side of a catalyst coated membrane followed by pressing to form the framed membrane electrode assembly array.

34. The fuel cell of Claim 32, wherein the at least one framed membrane electrode assembly component comprises a gas diffusion electrode, and a framed membrane electrode assembly array is prepared by pressing together a sandwich formed by the framed membrane electrode sub-assemblies formed in step (c) and an ion-exchange membrane disposed there between.

35. The fuel cell of Claim 32 wherein the at least one framed membrane electrode assembly component comprises a catalyst coated membrane, step (e) precedes step (d), and framed membrane electrode assembly components each comprising a gas diffusion layer are placed on either side of the framed membrane electrode sub-assembly formed in step (c), followed by pressing to form the framed membrane electrode assembly array.

36. The fuel cell of Claim 32 wherein the at least one framed membrane electrode assembly component comprises a proton exchange membrane, step (e) precedes step (d), and framed membrane electrode assembly components each comprising a gas diffusion electrode are placed on either side of the framed membrane electrode sub-assembly formed in step (c), followed by pressing to form the framed membrane electrode assembly array.